# CONTROL ENGINEERING *EUROPE*

# The new easy –
## digitalisation down to the field level

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# The new easy – digitalisation down to the field level

The digitalisation of a process will result in challenges. Higher data transfer rates will become as indispensable as more flexible architectures or the integration of wireless communication. However, with Profinet, an Ethernet-based standard is entering the process industries that masters all the challenges and impresses with its ease of use.

The process industries impose high demands on industrial communication – secure exchange of cyclical and acyclical data, integration of large quantity structures, overcoming large distances, real-time capability, operation in explosive environments etc.

In the modern office environment TCP/IP technology allows us to completely do without network cables because of wifi, and the integration procedure is simple. Either the printer is delivered with a fixed IP address, or it automatically receives one via DHCP (Dynamic Host Configuration Protocol), or a web interface permits safe integration into the network infrastructure. A comparably simple commissioning of field devices or uncomplicated set-up of flexible network architectures at the field level would be at the top of most operator/owner wish lists.

Users who want to experience this at the field level today use Profinet (Process Field Network). This open standard protocol, based on Industrial Ethernet, combines the functionality of Profibus with the benefits of Ethernet-based communication technology.

The Profinet standard follows the IEC Norm 802.3 to 100% and works at transfer rates of 100 Mbit/sec. The use of Ethernet also means that it is possible to profit from innovative technologies like the simple integration of web services, intelligent network management, consistent use of large data quantities far beyond the control room etc. In addition to all these benefits, Profinet stands out especially for use in process plants: for the simple integration of existing fieldbus technologies and thus the protection of legacy investments.

## The new flexibility

The introduction of bus systems, such as Profibus, about 25 years ago has clearly reduced the need for cable installation when compared to the analogue 4-20-mA technology and it greatly simplified the integration of field devices. However, these and the many other benefits that Profibus offers also come with limitations. For example, Profibus DP is limited to, at most, 125 connected slaves per segment, only one data channel between master and slave, and the data transfer is limited to, at most, 12 Mbit/sec. Alarms, messages, and status updates are all transferred with the same priority and only the creation of simple line structures comes as a standard. Profinet, however, offers much more: The choice of topology is completely free – Star, tree, line, or ring structures are possible – and so Profinet permits the creation of real networks.

The ring topology is especially interesting for the process industries. Closing a line into a ring creates a simple structure of a redundant communication path without any additional hardware. If an error, such as a broken cable, is detected then the connection to all participants of the segment is kept secure through smooth switching from ring to line structure. The underlying Media Redundancy Protocol (MRP) is specified in accordance with IEC 62439 and is fully supported by Profinet. It is not just the topology that is flexible. The use of diverse transfer media ensures even more flexibility. In addition to copper cables, Profinet architectures can also use fibre optic cables and Industrial WLAN or a combination of the above.

## Easy device integration

The new version 9.0 of the Siemens Simatic PCS 7 process control system supports this high-performance Industrial Ethernet standard without restrictions. Together with reliable Simatic automation products, the creation of Profinet networks is quick and easy. Devices are connected using switches – such as the new Scalance XF204-2BA DNA. It also offers a Y-switch functionality, with which S2 devices can be connected to a high-availability R1-system. Two further switch ports ensure that S2 devices can be connected to the Scalance switch via a redundant ring. In addition, switch functionalities are already integrated into many Siemens devices, such as controllers, remote I/Os and operator devices. Thanks to functions such as auto negotiation and auto crossover, communication can be established independently: Simply connect Profinet cables and start! Where you once had to enter and document parameters by hand, it is now simply Plug&Produce. This concept is supported by the Simatic Compact Field Unit (CFU), a new distributed I/O line developed by Siemens. For example, the PA edition of the modern field distributor makes connecting Profibus PA devices easier

than ever: all field devices connected to Simatic CFU are automatically addressed and integrated via standard profiles of Profibus & Profinet International (PI). Existing system components can, therefore, be comfortably retooled to Profinet and at the same time installation efforts are reduced as communication with the superimposed levels takes place directly via Profinet. This means there is no need for marshalling cabinets, multi-core master cables, terminal boxes etc. In contrast to previous Profibus installations, you can save up to 60% in cables!

## Switch devices in record time

In addition to cyclical process data, process systems also exchange acyclical data for alarms and messages, for example, as well as for parametrisation and diagnostics. Both communication types run next to each other without interruptions in Profinet. Diagnostic messages permit the status-based maintenance of system components. Connected Profinet components are maintained and monitored by the SNMP standard (Simple Network Management Protocol). The protocol uses diagnostic information of the network participants and reads port-specific data and information for the neighbourhood recognition of devices. Thanks to this property, changes in the

topology can be recognised during running operation and names assigned to components automatically.

What does this mean for the everyday operation of processing systems? An example: A Profibus PA device connected via Simatic CFU unexpectedly fails. Production stops. In addition to the LED diagnostic directly on the device, detailed reports are also provided in the Simatic PCS 7 Maintenance Station pursuant to NE107.* Thanks to Profinet and Plug&Produce, this is easy for the maintenance staff: due to neighbourhood recognition and standard profiles, they can use a replacement device with a different version status and even by a different manufacturer. The replacement device receives the same position and the same address in the network and automatically receives the same set of parameters as the failed device. The new device is ready to use after about one minute and production can start up again. This means it is much faster to replace defective devices compared to Profibus scenarios and even inexperienced technicians can do this.

## Higher availability

The I/O system Simatic ET 200SP HA also uses the benefits of Profinet optimally: redundant Profinet connections permit a connection to high-availability

controllers via two completely separate networks, optionally per copper or fibre optic cable. The I/O system is modular and can be scaled and expanded in small steps. Due to the large number of available modules it adapts optimally to every automation task. For example, digital and analogue I/Os as well as 4-20mA and HART devices can be connected. In addition to redundancy at the Profinet interface, the peripheral modules can also be redundant themselves. A terminal block for integrated I/O redundancy permits the use of redundant I/O modules for especially highly available applications in the process industries – without having to change any wiring. High system availability is also ensured by having the ability to pull and plug components during operation. This way it is even possible to expand stations without shutting the system down.

## Start today

The relatively long running times of process plants make it necessary to integrate existing field buses and the installed base during modernisation measures – no operator wants to, or is able to, re-network his field level all at once. Profinet thus integrates seamlessly into existing architectures. Using proxy technology, existing system components can be integrated into a Profinet infrastructure, for example with the Simatic CFU or Simatic ET 200SP HA. The use of such modern remote I/Os, proxies, and switches together with Profinet protects investment in established technologies and also allows digitalisation in the field to begin. This means that, while at the same time protects their existing system components, Profinet users can profit immediately from more flexible topologies, increased data throughput, more diagnostic information, the use of one cable for all applications (e.g. the integration of failsafe communication via Profisafe), and a clearly higher system performance.
*NAMUR recommendation 107: Self-monitoring and diagnosis of field devices, 12.06.2006.*